1993 IAF International Astronautical Congress
Paper Abstract

Planning the Mars Observer Orbit Insertion Phase

Suzanne Dodd and Ralph Roncoli
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California, USA

The Mars Observer spacecraft, which will provide global climatology and geoscience mapping of Mars over the period of a full Martian year, is scheduled to arrive at Mars August 24, 1993. Following a successful launch and interplanetary cruise prior to commencement of mapping, the Mars Observer mission will begin one of the busiest and most critical phases of the entire mission - the orbit insertion phase. The orbit insertion phase is the period of transition from the interplanetary trajectory to the near-circular mapping orbit around Mars, The baseline orbit insertion strategy involves a series of seven maneuvers executed over a period of approximately three and a half months to maneuver the spacecraft from its initial capture orbit with a dayside, descending node near 5 p.m. local mean solar time to the desired 2 p.m. mapping orbit solar orientation. Post launch performance analysis has determined that excess spacecraft **AV** capability exists which can be used to advance the beginning of the mapping phase by implementing nearly optimal out-of-plane maneuvers to rotate the line of nodes of the elliptical drift orbits more rapidly toward the desired 2 p.m. mapping orientation. This strategy is referred to as “Power-In”. This paper will discuss the design and planning of the orbit insertion phase and the science, operations, and maneuver design trade offs associated with using the available **AV** margin to advance the start of the mapping phase.

The baseline mission plan has the mapping phase beginning just as Mars is approaching solar conjunction and just after the beginning of southern spring. This is undesirable for science, because dust storm disturbances will normally begin in the southern hemisphere in early spring, resulting in increasing atmospheric obscuration as Mars approaches perihelion. Because the clearest atmospheric conditions are expected during northern summer, an earlier start of the mapping phase is highly beneficial for science. From an operations perspective, advancing the start of mapping provides more time prior to the solar conjunction command moratorium to insure the successful deployment of the spacecraft into the mapping configuration.

The use of spacecraft AV margin to advance the beginning of the mapping phase must be balanced against the necessity to save AV for potential anomaly recovery. Due to the large number of maneuvers required to be executed over a short period of time, consideration also has to be given to trading off the amount of mapping advancement against the operations time required to generate each maneuver. The final orbit insertion phase design represents a compromise between science and operations concerns, achieving the major goals of mapping advancement within the available spacecraft AV capability.